AbstractID: 13938 Title: Hybrid computational phantoms of the developing human fetus

Purpose: Anthropomorphic computational phantoms are a useful tool for assessing ionizing radiation doses delivered through medical imaging, radiation therapy, and nuclear medicine procedures. The majority of computational phantom construction efforts have been directed towards pediatric and adult populations, with comparatively little treatment given to the developing fetus. Fetal radiosensitivity combined with growing concerns regarding medical radiation doses suggests a need for computational phantoms that provide adequate representation of fetal anatomy. This work introduces a new set of fetal computational phantoms to be used for use radiation dosimetry purposes.

Method and Materials: High-resolution MR and CT images of two preserved fetal specimens (13.5 and 23 weeks) were utilized to construct computational phantoms of the developing fetus. 4.7 T MR images of the younger fetus and clinical 1.5 T MR and CT images of the older fetus were acquired. Images were segmented using *3D-Doctor*™ and exported to *Rhinoceros*™ where non-uniform rational B-spline (NURBS) surfaces were used to offset minor imaging and segmentation artifacts in the skeleton. Published fetal biometry data were used for age verification and as design criteria for volumetrically adjusting the phantoms to different gestational ages

Results: The thorough representation of the internal fetal anatomy comprising these phantoms is on par with currently available pediatric and adult computational phantoms.

Conclusion: High-resolution MR and CT images of two preserved fetuses, in conjunction with established segmentation and modeling techniques, have produced two computational phantoms that provide improved representation of the fetal internal anatomy compared to those currently available. In the future, completed fetal phantoms may be combined with an adult female phantom to provide a powerful tool with which to simulate *in utero* internal and external medical radiation exposures.

Conflict of Interest (only if applicable): N/A